Space Weather Technical Forecast

Issued on Tuesday, 02 July 2024 at 13:10 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: Chance of M-class flares throughout. Chance of G1/G2 Minor/Moderate storm intervals Days 1-2 (02-03 Jul) due to CME influences.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low in the last 24 hours with just C-class flares. There are currently thirteen regions on the disc, the majority of which are small and simple. AR3729 near south-centre disc is currently the largest and most complex region on the disc. It has recently developed some additional spots, including a small delta spot. AR3734 in the northeast quadrant is also a moderately long spot but smaller in areal extent, showing limited magnetic complexity, with some recent decay of its intermediate spots. AR3730 in the southwest has been declining after the M-class flare yesterday.

A CME was observed following the M2.1 flare on 01 July from AR3730 in the southwest quadrant, this has been reassessed and is now considered most likely to miss ahead of Earth's orbit on 05 July. No other Earth-directed CMEs have been observed in imagery during the past 24 hours.

Solar Wind / Geomagnetic Activity: Solar winds observed by ACE at L1 have been slightly elevated, on a declining trend. Wind speeds were initially near 480 km/s, falling to around 400 km/s. Density was mostly below average. The Interplanetary Magnetic Field, Bt, was weak throughout, below 4nT. The north-south component, Bz, varied weakly between +2/-3nT. Phi angle has been predominantly positive (away from the Sun). Geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux observed by GOES18 remained at background levels. High energy electron flux (greater than 2MeV) observed by GOES16 has been at background to moderate levels with a peak of 290 pfu at 01/1930 UTC. The 24-hour fluence remained below Active on a rising trend, with 5.44e6 integrated pfu observed at 02/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low activity is likely to continue, with a chance of isolated M-flares.

Solar Wind / Geomagnetic Activity: A large CME was observed leaving the Sun on 29 June, with a glancing blow likely either on Day 1 or Day 2 (02-03 Jul), although the bulk of the ejecta is passing below Earth's orbit. There is significant uncertainty in the timing of this feature, however. A second CME which left the Sun on 01 July has now been assessed as passing ahead of Earth, perhaps with a very slight chance of a glancing blow on Day 4 (05 Jul). There are no significant coronal holes on the disc to give any fast wind influence.

Geomagnetic activity is expected to be generally Quiet to Unsettled (Kp 1-3), with a chance of Active to G1/Minor storm (Kp 4-5) intervals and a slight chance of G2/Moderate storm intervals (Kp 6) on Days 1-2 under CME influence, however confidence is fairly low. Returning to mostly Quiet to Unsettled conditions during Days 3 and 4 (04-05 Jul).

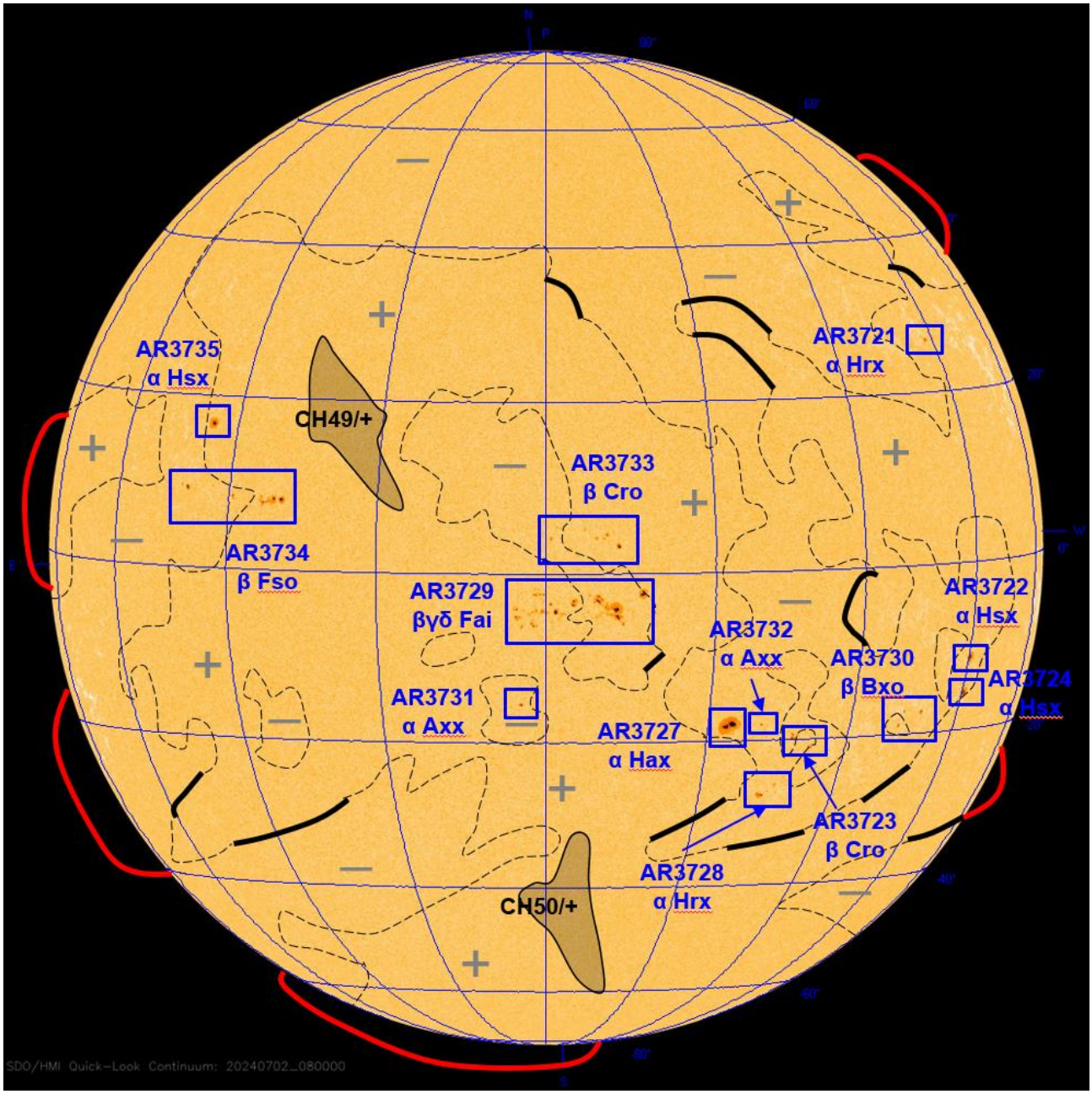
Energetic Particles / Solar Radiation: High energy proton flux is expected to remain at background levels. However, there is a very slight chance of exceeding the S1/Minor Storm threshold should any notable flares occur. High energy electron flux has shown an increasing trend after the recent CME influence, though suppression is likely with another glancing CME

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

arrival in the forecast. The associated 24-hour fluence is likely to remain below the Active threshold, however there is a slight chance of exceeding during this period.

Figure 1. Solar Analysis Valid 02/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Geomagnetic Storms:

A large filament lift-off was observed around 29/1530 UTC in the southwest, with a resulting large CME observed leaving the Sun in coronagraph imagery. Analysis suggests a glancing blow either on Day 1 or Day 2 (02-03 Jul), with the bulk of the ejecta passing below Earths orbit. There is significant uncertainty in the timing of this feature, however.

A second CME associated with the M2.1 impulsive flare from AR3730 in the southwest at 01/1102UTC which has now been assessed as passing ahead of Earth, perhaps with a very slight chance of a glancing blow on Day 4 (05 Jul).

There are no significant coronal holes on the disc to give any fast wind influence.

Geomagnetic activity is expected to be generally Quiet to Unsettled (Kp 1-3), with a chance of Active to G1/Minor storm (Kp 4-5) intervals and a slight chance of G2/Moderate storm intervals (Kp 6) on Days 1-2 under CME influence, however confidence is fairly low. Returning to mostly Quiet to Unsettled conditions during Days 3 and 4 (04-05 Jul).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	30	30	5	5
Strong	G3	No	5	5	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

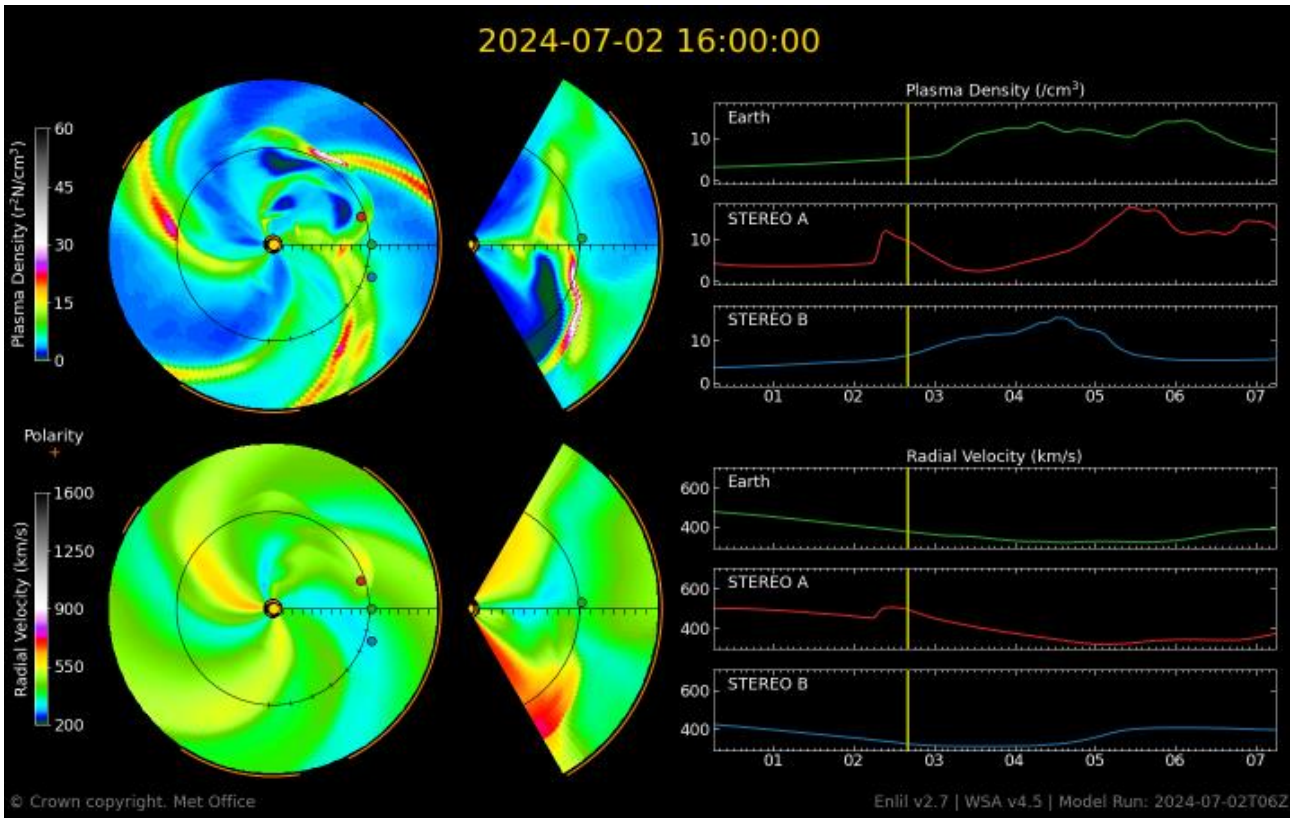
Geomagnetic Activity - Earthbound Coronal Mass Ejections

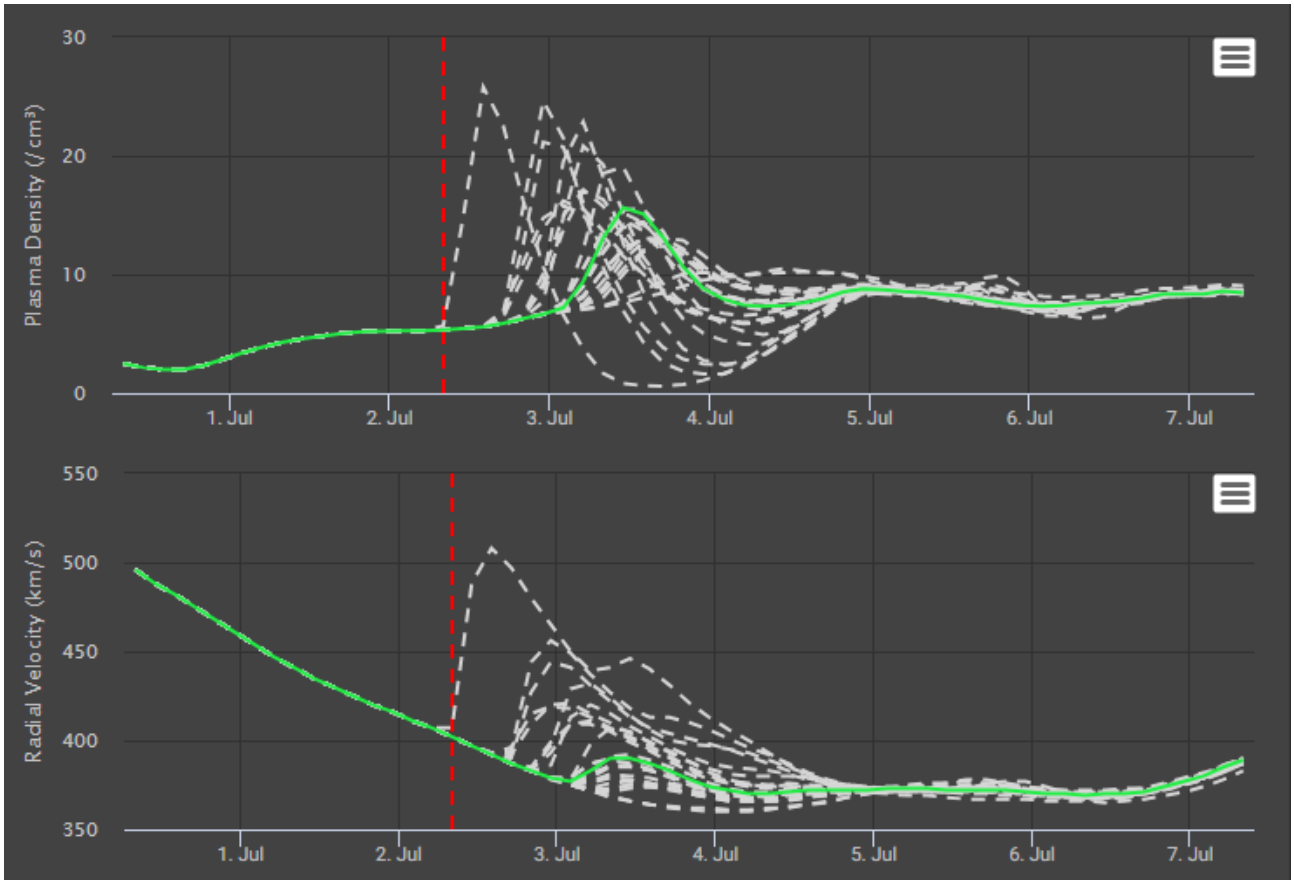
Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
29/2010	Partial	Filament	SW	780 km/s	03/0000 UTC +/- 12 hrs	Glancing blow likely. Timing uncertain.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 2: MOSWOC Enlil and ensemble, showing potential CME arrival in the next 24 hours.





Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

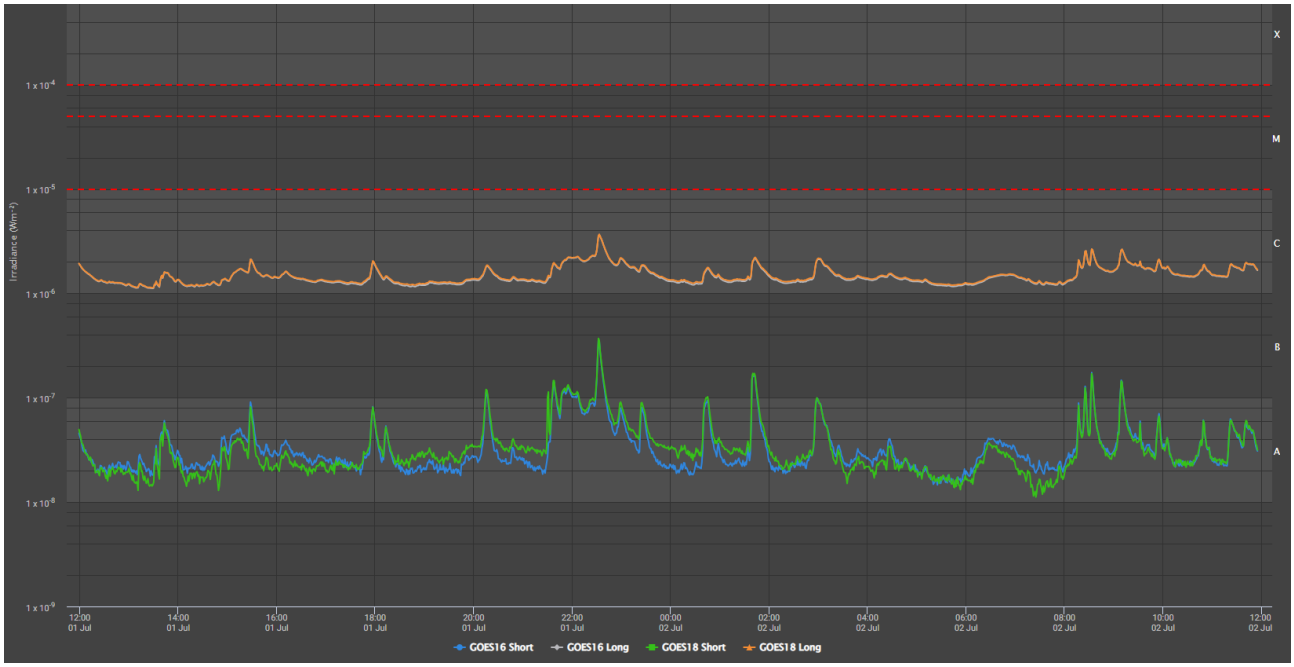
© Crown Copyright 2024. All Rights Reserved.

Radio Blackouts - X-Ray Flares:
There are currently thirteen regions on the disc, the majority of which are small and simple. AR3729 (Fai/Beta-Gamma-Delta), near south-centre disc, is currently the largest and most complex region on the disc. It has recently developed some additional spots, including a small delta spot. AR3734 (Fso/Beta) in the northeast quadrant is also a moderately long spot but smaller in areal extent, showing limited magnetic complexity, with some recent decay of its intermediate spots. AR3730 (Bxo/Beta) in the southwest has been declining after the M-class flare yesterday.

Each individual region only contributes a small amount to the overall flare risk. Overall, the flare risk has been kept flat throughout with a chance of isolated M-class flares, and a very slight chance of X-class flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	40	40	40	40
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: X-ray flux at GOES16/18 showing just C-class flares over the last 24 hours.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):
High energy proton flux, as measured by GOES-18, is most likely to remain at background levels. Despite a large amount of sunspots on the Earth-facing disc, they are relatively small and magnetically simple, making proton enhancements unlikely.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

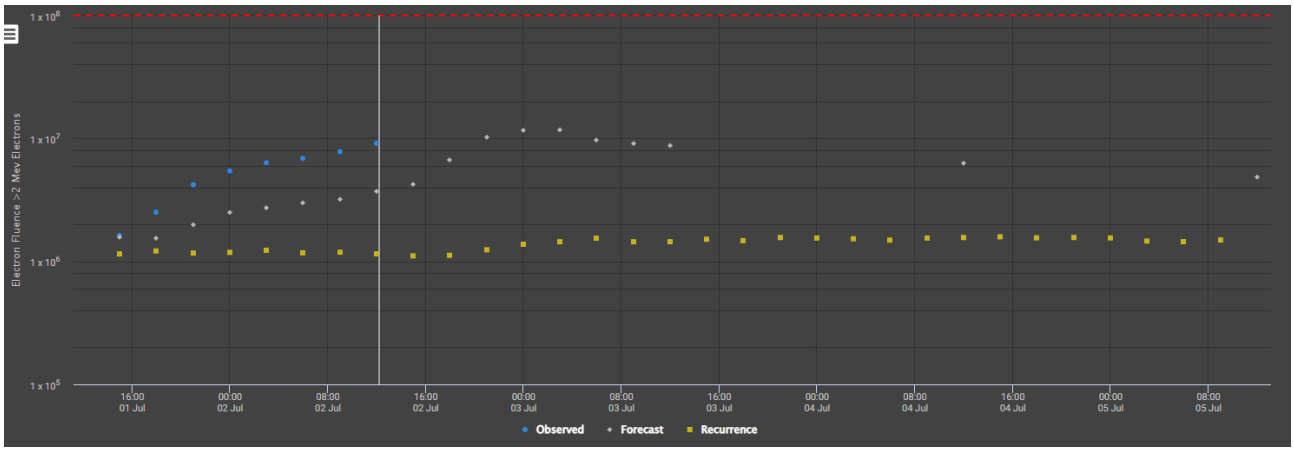
© Crown Copyright 2024. All Rights Reserved.

High Energy Electrons Event (≥ 2MeV):
High energy electron flux, as observed by GOES-16, has been at background to moderate levels over the last 24 hours after the recent CME enhancement caused a slight increase in electron flux. The potential for a further CME arrival on Day 1 or 2 (02-03 Jul) could suppress this once again. Overall, electron flux is most likely to stay at background to moderate levels, but a another slight rise is possible later in the period, should the anticipated CME give any significant geomagnetic activity.

Associated electron fluence is most likely to persist below the Active threshold (1e8 integrated pfu), but with just a slight chance of an increase above Active. MOSWOC REFM is forecasting a below Active trend through the next three days, which reflects the most probable outcome.

GEO Electron Environment Probability (Exceedance)	Level ($cm^{-2}\,sr^{-1}\,day^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	5	5	10	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: MOSWOC REFM showing a below Active forecast through the next 3 days.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.